

**REMARKS**

This preliminary amendment and response addresses the non-final Office Action (Paper No. 18) mailed by the U.S. Patent and Trademark Office on August 15, 2003, in U.S. Application No. 09/796,299, to which the instant application claims priority. Claims 1-21 remain pending in the present application. Claims 22-25 have been canceled without prejudice, waiver or disclaimer. In view of the foregoing amendment and following remarks, reconsideration and allowance of the present application and claims are respectfully requested.

**Rejections Under 35 U.S.C. §103****Claims 1, 9, 12 and 20**

Claims 1, 9, 12 and 20 stand rejected in the parent application under 35 U.S.C. §103(a) as allegedly being unpatentable over U.S. Patent No. 6,251,738 to Huang, in view of U.S. Patent No. 5,349,201 to Stanchina *et al.* and further in view of U.S. Patent No. 6,388,307 to Kondo *et al.* For a claim to be properly rejected under 35 U.S.C. §103, “[t]he PTO has the burden under section 103 to establish a *prima facie* case of obviousness. It can satisfy this burden only by showing some objective teaching in the prior art or that knowledge generally available to one of ordinary skill in the art would lead that individual to combine the relevant teachings of the references.” *In re Fine*, 837 F.2d 1071, 5 U.S.P.Q.2d 1596, 1598 (Fed. Cir. 1988) (Citations omitted). Further, “[t]he mere fact that the prior art may be modified in the manner suggested by the Examiner does not make the modification obvious unless the prior art suggested the desirability of the modification.” *In re Fritch*, 972 F.2d 1260, 1266, 23 U.S.P.Q.2d 1780 (Fed Cir. 1992).

It is stated in the Office Action that:

Huang discloses in figure 12 a Heterojunction Bipolar Transistor (HBT) comprising a collector 18, and emitter 44; and a base 22, less than 49 nm is located between the collector and emitter (see column 6, line 22).

Huang does not disclose the base layer being a GaAsSb layer with doping greater than  $6 \times 10^{19}$  acceptors/cm<sup>3</sup>.

Stanchina discloses at column 3, lines 39-47, a GaAsSb doped with Be provided improved performance over conventional HBTs by increasing the hole mobilities and valence band offset. Therefore, it would have been obvious to one of ordinary skill in the art at the time of the invention to use this material in the HBT structure of Huang in order to increase the performance (hole mobilities and valence band offset) of the structure.

Kondo discloses at column 7, line 23, a transistor with a base concentration of  $1 \times 10^{20}$ . Therefore, it would have been obvious to one of ordinary skill in the art at the time of the invention to dope the base of the structure in Huang in view of Stanchina to such a high impurity concentration in order to decrease the base resistance.

*Huang* appears to disclose a process for forming a *silicon-germanium* base of a heterojunction bipolar transistor over a *silicon* substrate. *See Huang, Abstract.*

*Stanchina et al.* appears to disclose a heterojunction bipolar transistor (HBT) formed over an *indium phosphide* substrate and which includes a base layer that is preferably 65 nanometers (nm) thick. Specifically, in a preferred embodiment, *Stanchina et al.* requires that the base layer 16 includes a 50 nm thick main layer 16a doped with beryllium (Be) to a free carrier concentration of approximately 3 to  $6 \times 10^{19}$  holes/cm<sup>3</sup>, with the preferred value being  $5 \times 10^{19}$ , and a spacer layer 16b disposed between the main layer 16a and the collector layer 14. The spacer layer 16b is preferably 15 nm thick, and doped with beryllium to a free carrier concentration of  $2 \times 10^{18}$  holes/cm<sup>3</sup> (see column 3, lines 29-38). Specifically, *Stanchina et al.* requires a base thickness of at least 65 nm.

*Kondo et al.* appears to disclose a bipolar transistor using a B-doped *silicon* and *germanium* alloy for a base in which a *germanium* content in an emitter-base depletion region and in a base-collector depletion region is greater than a germanium content in a base layer. See *Kondo et al.*, Abstract. The substrate for the HBT in *Kondo et al.* is *silicon*.

In marked contrast thereto, claim 1 includes an HBT including at least “*a base located between the collector and the emitter, the base including a layer of gallium arsenide antimonide (GaAsSb) less than 49 nanometers (nm) thick and having a doping concentration greater than 6 X 10<sup>19</sup> acceptors/cm<sup>3</sup>*” and claim 12 includes at least “*forming a base located between the collector and the emitter, the base including a layer of gallium arsenide antimonide (GaAsSb) less than 49 nanometers (nm) thick and having a doping concentration greater than 6 X 10<sup>19</sup> acceptors/cm<sup>3</sup>*.”

Applicants respectfully submit that at least these features are neither disclosed, taught, nor suggested by the proposed combination.

No Motivation to Combine *Huang* with *Stanchina et al.* and *Kondo et al.*

Applicants respectfully submit that there is no motivation to combine *Huang* with *Stanchina et al.* and *Kondo et al.* to arrive at the present invention. “Obviousness cannot be established by combining the teachings of the prior art to produce the claimed invention, absent some teaching or suggestion supporting the combination. Under section 103, teachings of references can be combined only if there is some suggestion or incentive to do so.” *ACS Hospital Systems, Inc., v. Montefiore Hospital*, 732 F.2d 1572, 1577, 221 USPQ 929, 933 (Fed. Cir. 1984).

Further, “[t]here must be some reason, suggestion, or motivation found in the prior art whereby a person of ordinary skill in the field of the invention would make the

combination." *In re Oetiker*, 977 F.2d 1443, 1447, 24 USPQ2d 1443 (Fed. Cir. 1992).

Applicants respectfully submit that there is nothing in *Huang*, *Stanchina et al.* and *Kondo et al.* that would motivate one having ordinary skill in the art to combine these references to arrive at Applicants' invention. Further, the proposed combination fails to provide either a reasonable expectation of success of combining the references to achieve the thin base of the invention, or show any relevance to the problem solved by Applicants' invention. Further, the Office Action fails to articulate a clear motivation to make the proposed combination.

Specifically, Applicants respectfully submit that the Office Action fails to establish a *prima facie* case of obviousness because the Office Action has not pointed out the specific teachings in *Huang*, *Stanchina et al.* and *Kondo et al.* that would motivate one having ordinary skill in the art to combine the references to arrive at Applicants' invention. Indeed, the proposed combination of *Huang*, *Stanchina et al.* and *Kondo et al.* fails to disclose, teach or suggest an HBT formed on a gallium arsenide substrate that includes a thin, heavily doped base layer formed using gallium arsenide antimonide.

Further, Applicants respectfully disagree with the conclusory statement in the Office Action that:

[i]t would have been obvious to one of ordinary skill in the art at the time of the invention to use this material [referring to *Stanchina et al.*] in the HBT structure of *Huang* in order to increase the performance (hole mobilities and valence band offset) of the structure.

Applicants respectfully submit that one having ordinary skill in the art would *not* be led toward combining *Huang*, *Stanchina et al.* and *Kondo et al.* because the substrate for the devices disclosed by *Huang* and *Kondo et al.* is *silicon*, while the substrate for the device disclosed by *Stanchina et al.* is *indium phosphide*.

Applicants respectfully submit that an HBT constructed using a silicon germanium base over an indium phosphide substrate would be inoperative. Accordingly, Applicants respectfully submit that the proposed combination teaches away from Applicants' invention and is therefore improper.

Accordingly, Applicants respectfully submit that independent claims 1 and 12 are allowable over the combination of *Huang, Stanchina et al.* and *Kondo et al.*, and furthermore, that dependent claims 2-11 and 13-21 are allowable for at least the reason that they depend from allowable independent claims. *In re Fine, supra.*

Claims 10 and 21

Claims 10 and 21 stand rejected under 35 U.S.C. §103(a) as allegedly being unpatentable over *Huang, Stanchina et al.* and *Kondo et al.* as applied to claims 1 and 12 above, and further in view of U.S. Patent No. 6,316,795 to Croke, III.

It is stated in the Office Action that:

Huang in view of Stanchina and Kondo renders obvious the limitations in the claims, as discussed above, except for carbon being used in the base. Croke, III teaches at column 1, lines 43-50, carbon is used in the base of a HBT. Therefore, it would have been obvious to one of ordinary skill in the art at the time of the invention to use carbon, since carbon, unlike some other dopants used in the transistor layer doping, does not have a tendency to out diffuse from the layer being subjected to doping.

For at least the reasons discussed above with respect to claims 1 and 12, Applicants respectfully submit dependent claims 10 and 21 are allowable in that they depend from allowable independent claims. *In re Fine, supra.*

**CONCLUSION**

For at least the foregoing reasons, Applicants respectfully request that all outstanding rejections be withdrawn and that all pending claims of this application be allowed to issue. If the Examiner has any comments regarding Applicant's response or intends to dispose of this matter in a manner other than a notice of allowance, Applicants request that the Examiner telephone Applicant's undersigned attorney.

Respectfully submitted,

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